

**The Impact of Small-Group Multisensory Instructional Techniques**

**on Kindergarteners' Letter Sound Knowledge**

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Capstone Project: An Action Research Project

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### **Abstract**

This action research was driven by the researcher's interest in multisensory instructional techniques and the effect it can have on kindergarten students' letter sound knowledge to aid in strengthening pre-reading skills. The researcher compared results of a control (traditional learning) group versus a treatment (multisensory learning) group of eight at-risk students while monitoring progress weekly using FastBridge earlyReading letter sound subtest. The research was conducted to analyze the effectiveness of multisensory instruction within small group learning. The researcher used a four-way factorial design test to analyze the control and the treatment group's pre- and post-test scores in letter sound fluency. During the week prior to the intervention, baseline data was collected for each students' ability to state 100 randomly assorted letter sounds in one-minute. The next four weeks consisted of traditional phonics instruction for the control group and multisensory phonics instruction for the treatment group. To finish the study, letter sound data was collected in the same format as prior to the intervention. The findings revealed students in the treatment group had significantly higher letter sound growth than those in the control group. This research was conducted to impact future classroom practices as well as school-wide decisions when choosing instructional practices pertaining to small-group phonics instructional interventions.

*Keywords:* multisensory learning, small group learning, phonics, kindergarten

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## **The Impact of Small-Group Multisensory Instructional Techniques on Kindergarteners' Letter Sound Knowledge**

A student's ability to read relies on a solid understanding of letters matching individual sounds. This knowledge lies within the alphabetic principle: the recognition of letters representing the sounds in spoken words. Acquiring this knowledge is crucial when learning how to read and write (Buckingham et al., 2019). Children as young as four years old benefit from instruction in the alphabetic principle that is presented in an interesting, yet systematic manner (Buckingham et al., 2019).

Explicit teaching of phonics is a crucial factor when teaching reading. Early phonics interventions promote reading development, and the teaching of phonemic awareness to young students correlates with later literacy skills (Double et al., 2019). For students to remember how to read words using grapheme-phoneme connections, they must first know letter shapes, names, and sounds (Ehri, 2020). This knowledge helps in progressing students from the pre-alphabetic phase to the partial alphabetic phase of word-reading development (Ehri, 2020).

The Iowa Common Core kindergarten literacy standards expect students to read emergent-reader texts by the end of the kindergarten school year. For students to achieve this goal, explicit teaching of phonics should be incorporated into the classroom (Double et al., 2019). Kindergarten students enter the classroom with a wide range of academic experiences and skills, as well as variance in how they learn instructional material best. Letter name and sound recognition are initial alphabetic principle skills taught to students to develop the necessary beginning reading skills. Teachers vary in their instructional approaches to teaching these skills to students with a range of prior experience and understanding.

The problem is teachers are challenged to find the most effective instructional format to accommodate students' varying learning abilities. Small-group learning is often used, but a teacher still must understand and design instructional formats that will increase student learning to become proficient in a given standard. One approach is to incorporate multisensory learning, which involves activities that engage at least two sensory modalities with direct and explicit lessons that include systematic phonics instruction (Schlesinger & Gray, 2017). According to Schlesinger & Gray (2017), teaching that engages a student's sensory modalities along with their linguistic system can enhance learning. Such strategies include using fingers and hands to tap out sounds in a word, to hearing and stating a letter name, then writing and tracing it in sand (Johnston, 2019; Bear, 2022).

The purpose of this action research study is to determine how small-group instruction that incorporates multisensory instructional techniques impacts struggling kindergarten students' letter sound knowledge. The findings of this study have the potential to improve classroom teachers' practice when working with students struggling to learn letter sounds. Teachers experience a multitude of learning styles and preferences yearly in the classroom; incorporating learning through auditory, visual, and tactile/kinesthetic practices has the potential to better meet students' varying learning needs. Although there are studies within the last 10 years that address the benefits and importance of small-group learning, some with specific connections to multisensory techniques, there are few that showcase specific outcomes of strict multisensory learning within small-groups to increase beginning reading skill in letter sounds. This research project will help other interested individuals see the direct correlation between small-group multisensory instruction and student letter sound knowledge.

Resources for this action research study were found through the DeWitt Library at Northwestern College and Google Scholar. Studies used were published within the last 10 years in peer-reviewed journals. Key topics within the studies were multisensory learning/approach, phonemic awareness, phonics, alphabetic principle, movement in the classroom, reading instruction, and the Orton-Gillingham approach. The 20 chosen studies guided in understanding current knowledge and identifying existing gaps in research on multisensory instructional approaches in small-group instruction.

### **Review of the Literature**

This literature review summarizes the research on the effects of multisensory approaches on young learners. It explains the importance of phonics in the reading development process and how multisensory techniques can support phonics instruction. The review will also discuss multisensory approaches and instruction and how they impact student learning.

### **Multisensory Learning**

Multisensory approaches are instructional techniques for teachers to integrate into early childhood learning that support academic learning concepts. Multisensory learning includes auditory, visual, and movement-based strategies to enhance the components of instructional content (Sayeski et al., 2019). All modalities are involved to assist in repetitive practice, modified instruction, and various depictions of concepts (Sayeski et al., 2019). This method activates different parts of the brain to stimulate learning responses to instruction and benefits students, especially those with dyslexia (Johnston, 2019). A multisensory approach enhances the structure of language across the speech sound system (phonology), the writing system (orthography), the arrangement of sentences (syntax), the relevant parts of words (morphology),

the link among words (semantics), and the grouping of spoken and written discourse (Johnston, 2019).

Researchers have explored teacher knowledge and perceptions of multisensory teaching and learning. Boardman (2020) conducted a study that explored the use of multisensory approaches and teaching experiences through engagement with a specialist dyslexia training program; the researcher tracked teachers' perceptions throughout the experience. Teachers were asked 10 quantitative and qualitative questions regarding perceptions of multisensory approaches and teaching experiences with the opportunity to expand on and clarify individual responses. After reading through responses, six focus groups were selected to answer open-ended questions relating to their experiences and perceptions on the impact of multisensory teaching. The research ended with a final survey at the end of the training program (Boardman, 2020).

Boardman (2020) found a wide range of responses within the first survey group regarding the perceptions of what multisensory teaching and learning is—from understanding that it includes hands-on practice experiences to teaching that offers enhanced activities to differentiate learning. Of the teachers sampled, 157 reported that they feel multisensory teaching is beneficial for all learners but only 64 were currently implementing the approach into everyday practice. The focus group responses allowed for elaboration as to why implementation was not occurring; the data suggests that not implementing these strategies is linked to a lack in knowledge/pedagogic confidence, time, and resource implications. The teachers want to use a multisensory approach but lack confidence in the application, knowledge, and skills to implement it fully in the classroom. Upon completion of the specialist dyslexia training program, 178 teachers recorded improvement in their knowledge regarding multisensory teaching compared to the 73 teachers who graded themselves as good or excellent regarding multisensory

teaching at the start. According to Boardman (2020), this study emphasized teacher knowledge with multisensory teaching and how teacher training in multisensory instruction can increase teacher confidence and skills.

Though recognizing the benefits of multisensory learning, research suggests that teachers do not generally understand the approach. Primary teachers are more versed in teaching through multisensory experiences, but the guidelines for whole-group multisensory teaching are not as explicitly stated as it is a strategy more commonly used in small intervention groups (Boardman, 2020). Boardman (2020) concludes that a scope to develop and encourage a deeper understanding of multisensory pedagogy for all experienced teachers should be initiated.

Positive effects of a multisensory learning activities are evident in student learning. Broadbent et al. (2018) aimed to examine the role of multisensory information on incidental category learning during a sustained attention task. This study of 60 six-year-olds, 60 eight-year-olds, and 61 10-year-olds examined the role of unimodal and multimodal information on alertness and incidental learning of categorial information using the multisensory attention learning task (MALT). During 20-minute sessions, seven different animal line drawings were examined using visual (unisensory), auditory (unisensory), and audiovisual (multisensory) learning conditions. Students responded to various prompts regarding the animal line drawings.

Broadbent et al. (2018) found that students as young as six years of age displayed a higher performance on incidental categorization tasks after they were presented multisensory (audiovisual) cues compared to unisensory cues (visual or auditory alone). The group of six-year-olds performed at chance following the learning with auditory-only cues, but above chance with visual and audiovisual cues. Multisensory (audiovisual) cues also resulted in an enhanced performance on incidental learning of all categories across all age groups tested. Some



performances correlated with age—such as the category identification task that followed audiovisual learning and auditory-only learning, but not with visual-only learning. Broadbent et al. (2020) conclude that the use of multisensory integration, particularly auditory and visual, may experience a prolonged developmental plan throughout early primary school years. The findings support the start of multisensory learning tasks within primary education.

The two studies did not have differences in their conclusions as they both found that multisensory instruction is influential in student learning. The researchers found a need for the integration of multisensory learning into primary schools to support student learning experiences. The research supports the idea that multisensory instruction guides student learning in a positive direction.

### **The Importance of Phonics in the Reading Process**

Phonics is a crucial area of academic learning that plays a role in students' development in the reading process. Understanding the relationships between letters (graphemes) and sounds (phonemes) is an essential teaching component before starting to read (Double et al., 2019). Ehri and Flugman (2018) wanted to conduct a study on the effectiveness of teaching systematic phonics to improve kindergarten through third-grade students' achievement in reading and spelling. Teachers were mentored for a year on how to teach phonics explicitly and systematically through Orton-Gillingham-based programs. Students were taught precise sounds for each letter or letter combination, how to blend them into words when reading, and how to write them when spelling. As learning progression occurred, syllable and morphemic patterns, as well as spelling rules, were implemented for older students (Ehri and Flugman, 2018).

Ehri and Flugman (2018) found that the phonics mentoring program was exceedingly effective in positively impacting student learning, as well as teachers' knowledge with high quality systematic phonics instruction. Ehri and Flugman (2018) suggest that pre-service teacher preparation programs strengthen their training in phonics instruction, and that in-service programs provide high-quality PD regarding how to teach phonics to maximize effectiveness.

Having a curriculum that supports phonics instruction is a key component in effective teaching. Sanden et al. (2022) wanted to better understand how teachers in Illinois taught phonics after claims from journalistic rhetoric surfaced of phonics instruction failing to be implemented into schools. A survey was sent to over 400 teachers in kindergarten through second grade classrooms, with 97% of them responding yes to teaching phonics. Of the responses, 80% reported using a published curriculum to guide their instruction, 78% had a curriculum mandated by their school district and 69% received training to implement the program (Sanden et al., 2022). The top curricula (Heggerty and Wilson's Foundations) named by the participants are based in phonics-centered approaches with explicit ties to science-of-reading philosophies. Like the suggestions of Ehri and Flugman (2018), a need for colleges and in-service learning to support phonics trainings and instructional approaches was noted by teachers (Sanden et al., 2022).

As phonics instruction is occurring, a teacher must assess students in their learning to ensure proficiency once a standard is achieved. Piasta et al. (2018) conducted a study to discover the effects of the letter-sound short forms (LSSF) assessment on preschooler's alphabetic knowledge. This study lasted from the fall academic year of preschool into the subsequent academic year of kindergarten to acquire a full calendar year of LSSF data. The quantitative study found that the LSSF assessment produced data to guide educators' practice without

wasting instructional time. Evidence suggested that relations between letter-sound knowledge and phonological awareness skills were present, prerequisite skills for the acquisition of alphabetic principle and decoding skills. Piasta et al. (2018) suggests that an assessment tool that serves a dual purpose, such as the LSSF, should be put into place to guide decisions around alphabetic knowledge instruction.

An individual may wonder how a student progresses throughout the elementary years with learning phonics skills. Double et al. (2019) conducted a study in England to evaluate the longitudinal reading comprehension performance of students who were proficient in phonetic decoding screening versus students who first failed then passed the screening, and those who were unable to pass the screening within the school year who had to retake the screening at the start of the following school year. Students had to read aloud 20 words and 20 pseudowords. If they did not read at least 32 words correctly, they had to retake the screening the following school year. Double et al. (2019) also examined the students' reading comprehension performance one and four years after the initial screening.

Double et al. (2019) found that students who showed difficulties with the first screener went on to reach adequate standards at the time of the second check-in at the four-year mark. The research suggests that phonics screener check-ins can be an important tool to determine early difficulties for students with phonics skills to identify early interventions and to continue in monitoring the reading performance skills progress. This research aligns with Piasta et al.'s (2018) suggestion of using assessment tools to inform and guide decisions regarding phonics instruction, as well as Ehri and Flugman's (2018) findings of the importance of teaching systematic phonics instruction.

### **The Impact of Multisensory Instruction on Different Groups**

Different groups of students can respond to multisensory instructional approaches in varying ways. Schlesinger and Gray (2017) studied the impact of multisensory instruction with second-grade students of typical development and those with dyslexia in learning letter name and sound production, word reading, and word spelling. Students were taught two created alphabets of pretend language, the first group through structured language and the second group through multisensory. All results had a mix in which participants responded to a given approach better than to others. For example, in letter name production, typical development participants showed a greater effect in learning with multisensory instruction over structured language; but in words correctly spelled, dyslexia participants in the structured language intervention showed an advantage over multisensory (Schlesinger & Gray, 2017). Schlesinger and Gray's (2017) study supported structured language instruction within an Orton-Gillingham-based program to improve decoding and encoding skills for students with typical development and dyslexia. Both intervention techniques can be used in conjunction to promote student learning.

Similar results in favor of multisensory instruction followed in a study by Labat et al. (2020). This study was based around multisensory letter integration helping to acquire letter shape and decoding skills with 36 five- and six-year-olds in France (Labat et al., 2020). Both groups combined a motor experience with implicit learning: one group taught with strictly visual learning while the second was taught using visuo-motor learning. Letters were displayed on a computer in random order with motor action instruction varying per group: the visual group followed the cursor and letter shape with their eyes while the visuo-motor group traced the letter with their finger. Students would state if the letter on the screen correlated with the correct sound as well as decoded pseudo-words. Both groups improved their scores from pre- to post-test scores, but a reduction with inaccuracy when stating a sound and when decoding decreased more

in the visuo-motor group compared to the visual learning group. Labat et al. (2020) suggest that multisensory experiences of audio-visual-motor in letter knowledge contributes to better letter recognition and improvement in decoding than audio-visual learning.

The integration of active movement into instruction is a sensory type that can improve educational outcomes. A specific focus on incorporating movement while learning was studied by Turner and Chaloupka (2017) and Grieco et al. (2016). Turner and Chaloupka (2017) surveyed 640 public elementary schools within the U.S. regarding the effect of active lessons and breaks within the classroom. They found that 71.7% of schools indicated that at least one of their teachers used active lessons, 18.1% did not know, and 10.2% did not use active lessons. Regarding active breaks, 75.6% of schools used them, 13.7% did not know, and 10.7% did not use active breaks. Turner and Chaloupka (2017) suggest from specific literature showcasing the academic benefits of activity in a school day that a more focused effort to improve implementation of active lessons and breaks should occur to increase educational outcomes for students.

Studying 320 7-to-9-year-old students in Texas, Grieco et al. (2016) studied the difference in physically active versus traditional lessons and how students' time on task was affected. Four different groups worked on spelling relay activities, ranging from a sedentary, non-competitive traditional lesson to a moderate-vigorous physical activity game lesson. The time on task in the first two styles, sedentary lessons, decreased or did not change while both physically active lessons' time on task significantly increased. The fourth, most active and competitive learning game was nearly three times the positive effect of the third low-to-moderate active learning game, suggesting there may be benefit to a game-type format in lessons that include physical movement because of the outperformance (Grieco et al., 2016). This finding

connects to Turner and Chaloupka's (2017) suggestion of active lessons improving educational outcomes for students.

The research continues to show that multisensory instruction shows a positive correlation with student learning. Jeyabalan et al. (2017) examined the impact of a multisensory approach on phonemic awareness skills with indigenous preschoolers in Malaysia over 12 weeks. An experimental group of students received multisensory instruction through Zoo Phonics while a control group learned through a traditional approach. Improvement in phonemic awareness skills, as well as accurate blending and segmenting, was notable with the experimental group compared to the control. Jeyabalan et al. (2017), Schlesinger and Gray (2017), and Labat et al. (2020) have similar findings, agreeing that the incorporation of multisensory techniques positively benefits student learning.

### **Multisensory Instruction in the Classroom**

Various multisensory instructional techniques can be integrated into the classroom to influence student learning results. Bear (2022) states that using a visual-auditory-kinesthetic-tactile approach, such as those found in Orton-Gillingham practices, helps in acquiring word text skills. Articulation, how and where sounds are formed in the mouth, is a part of the multisensory experience; beginning and emergent readers use the way they hear and feel sounds and letter names to guide them in predictable spelling (Bear, 2022).

Pieretti et al. (2015) studied two preschool students with severity in their speech deficiency using both traditional articulation therapy and the FONEMZ multimodal program, selecting one attainable target sound and two randomly selected consonant phonemes that were consistently misarticulated for each student. Student A demonstrated accuracy across the three

selected sounds, as well as beginning sound awareness. Student B slightly improved their accuracy with two target phonemes and greatly improved with one target phoneme, as well as showcased early reading success with upper and lowercase recognition, beginning sound awareness, print and word awareness, and rhyme awareness. The study supports the researchers' hypothesis that multimodal approaches, specifically ones that support sound-symbol development through visual modality, are effective in strengthening articulation, phonological awareness, phonics, and overall pre-literacy skills of young students (Pieretti et al., 2015).

A study using multimodal approaches to improve speech sound correlation and phonological skills showed similar findings. Preece and Zhao (2015) in England used a quantitative approach with 27 school-based professionals in England to determine how multisensory storytelling improved day-to-day practice in a classroom of students with profound and multiple learning difficulties. The same story was presented to students in different ways depending on their individual preferences, tolerances, and needs. Preece and Zhao (2015) found that the interactive and exploratory makeup of multisensory storytelling provided multiple communication opportunities and aided in the development of memory, anticipation, requesting, and focused attention. But because it was used in conjunction with other strategies, such as phonics boxes and visual teaching, Preece and Zhao (2015) admit that is difficult to identify the specific impact on learning and development from the multisensory storytelling sessions.

The two studies show that multisensory instructional approaches are valuable to student learning and validate that multisensory learning should be integrated into learning to help young students continue improving their phonics skills to guide them through the pre-reading process.

However, there are factors that can limit student learning results with multisensory techniques. Stevens et al. (2021) studied the effects of branded versus unbranded Orton-

Gillingham interventions with students identified with or at-risk of word-level reading disabilities in kindergarten through 12<sup>th</sup> grade. The study found that the effect of Orton-Gillingham interventions on students did not produce significantly greater benefits than students in the comparison group. However, there was a mean effect of 0.22 with the Orton-Gillingham intervention group, showing that the intervention may have positively impacted student outcomes among those who previously demonstrated limited response to early reading interventions (Stevens et al., 2021).

### **The Advantages of Multisensory Instruction**

Multisensory instruction has positive advantages and improvements on student learning. Magpuri-Lavell et al. (2014) conducted a quantitative study in a large urban city in the southern region of the U.S. that asked the questions: What is the effect on student ability to apply word recognition skills, what is the effect on sound-symbol knowledge understanding, and do students gain increased proficiency in oral reading fluency? The study included 39 students ranging between seven and 11 years old in a summer reading program over four weeks. Magpuri-Lavell et al. (2014) used the Simultaneous Multisensory Institute for Language Arts (SMILA) approach to enhance reading proficiency. Magpuri-Lavell et al. (2014) found a significant increase from the pre-test to post-test scores in both regular and pseudo word knowledge, sound-symbol relationships, pseudo word spelling, and reading fluency. A small decrease in regular word spelling was also present. Magpuri-Lavell et al. (2014) suggest that the SMILA approach can be a potentially effective method in teaching struggling readers the necessary foundational skills for reading success.

Developments in growth with pre-reading skills can be focused on through multisensory instruction. Bøg et al. (2019) suggest that multisensory tutoring programs increases at-risk



students' reading skills. The researchers conducted a quasi-experimental study in Southwestern Sweden with 130 kindergarten and 31 first grade students in 12 Swedish elementary schools for 10 weeks. The experimental group received instructional interventions in the multisensory reading program Läsklar while the control group received traditional reading instruction. Bøg et al. (2019) found that students who trained with the multisensory program could decode six more words and knew seven more letters than the control group students by the end of the study period. Like Magpuri-Lavell et al. (2014), Bøg et al. (2019) found multisensory instruction to positively impact student learning compared to traditional learning approaches.

Ring et al. (2017) compared two Orton-Gillingham-based curriculums to see which improved basic reading skill deficits associated with reading disabilities in a hospital-based learning disabilities clinic. Individuals in the study were being treated for a diagnosed reading disability and ranged from seven to 14 years old, grades three through five. An experimental and control group based on curriculum type were established, the experimental group using the Take Flight curriculum and the control group using the Dyslexia Training Program curriculum. Both included similar phonics concepts, such as phonemic awareness and syllable division rules, but the Take Flight curriculum consisted of two alternating daily lesson plans rather than one while the Dyslexia Training Program used strategies such as skywriting and gross motor movements when tracing letters (Ring et al., 2017). Results found no significant curriculum effect difference in students' word reading or phonological decoding skill gains, meaning that both approaches produced growth using the various multisensory techniques within the lessons. Ring et al. (2017) conclude that the study's results are consistent with previous studies, stating that the teaching of phonological awareness and letter-sound correspondences improves phonological awareness,

phonological decoding, and reading skills. Their study builds on current research on the Orton-Gillingham approach to phonics instruction.

These three studies do not differ in results. The researchers and their studies all found that multisensory instruction has a positive impact on improving student learning with phonics skills. The difference in research would be that the studies were conducted with various elementary age levels and in different parts of the world. The different environments of the studies do not influence the results: multisensory instruction improves students' phonics knowledge and skills to aid in necessary reading skills.

Multisensory instruction has shown positive effects on students developing the necessary phonics skills to help in becoming readers. The studies show there is a need for teacher understanding around teaching multisensory instruction and implementing it with fidelity into the classroom to support phonics learning. Multisensory learning should be implemented into daily phonics learning of early childhood learners, and educators should be prepared and knowledgeable surrounding the topic.

### **Methodology**

The action research plan will be described in this section by identifying the participants and research site, intervention and timeline, variables, and measurement tool. The intended question for this action research is the following: Does teaching letter sounds with multisensory instruction have a positive impact on student learning?

### **Participants and Research Site**

This action research study was in a kindergarten classroom of 18 students, with eight at-risk students participating in a letter sound intervention. The classroom was located in a Carroll, Iowa elementary school that consists of four preschool, two transitional kindergarten, six

kindergarten, six first-grade, and five second-grade classrooms. Demographics throughout the district include 85.4% White students, 6.6% Hispanic students, 3.8% Black students, 3.4% multi-race students, 0.7% Asian students, and 0.1% Native American students (Iowa School Performance Profiles, 2022). The free and reduced rate is 32.2% (Iowa School Performance Profiles, 2022).

The students in the featured kindergarten room range from five to six years old. There are five girls and three boys included in the research. Five of the students are white, and two are Hispanic immigrants who speak predominately Spanish.

Within the letter sound intervention group there was a control group and a treatment group. Names were drawn to randomly assign students to their group, and both groups were taught by the same teacher. The control group consisted of four students, three girls and one boy. In the control group, one of the students received daily ESL services while all four students received daily Title I services for additional reading support. The control group was taught letter sounds using visual and auditory modalities. The treatment group consisted of four students, two girls and two boys. In the treatment group, one of the students received daily ESL services while all four students received daily Title I services for additional reading support. The treatment group was taught letter sounds using visual, auditory, and kinesthetic modalities (multisensory).

### **Intervention and Timeline**

Both groups received whole group instruction that followed the Really Great Reading phonics curriculum mandated by the district for teaching. Intervention small groups met daily for 15 minutes. The teaching was kept consistent and routine to yield the most accurate data results assessing student learning.

For the control small-group intervention, students used visual and auditory modalities (traditional methods) to learn letter sounds. Two letter sounds were retaught per session in a nonsequential order, and each session started with an alphabet flash card drill. A mini-lesson was then conducted for the two letter sounds, and students would participate in repeatedly saying the letter sound while looking at the capital and lowercase letter form. Students also looked at the correlating letter tiles that matched the targeted letter sounds. After the mini-lesson, activities such as “I Spy” and “Sound Freeze” were conducted to help students in connecting the visual look of the letter with the auditory sound it makes.

For the treatment group intervention, students used visual, auditory, and kinesthetic modalities (multisensory methods) while learning letter sounds. Two letter sounds were retaught per session in a nonsequential order, and each session started with an alphabet flash card drill. A mini-lesson was then conducted for the two letter sounds, and students would participate in repeatedly saying the letter sound while looking at the capital and lowercase letter form, skywriting the letter while stating the sound, and drawing the letter in a sand tray while stating the sound. An action was then taught to help students remember the sound. Students also had letter boards where the researcher stated a letter sound, students found the correct letter, and students placed it on their building board. After the mini-lesson, activities such as “Splat” and tracing the stated sound in a shaving cream bag were conducted to help students connect the appearance of the letter with the auditory sound it makes and the physical strokes it takes to form the letter.

Both the control and treatment group also had three instances in which letter sounds could be practiced throughout the week outside of the intervention: during whole-group phonics instruction, during Title I reading instruction with a different instructor than the researcher, and

during the word work literacy center in the classroom. The researcher also sends home monthly letter sound practice sheets that parents and guardians have the opportunity to use with students (although this is not a mandatory requirement, and it is unknown whether the students participated in this additional practice).

The data collection was executed during a six-week-period. The pre-data was collected during the first week. The interventions were implemented for four weeks, and the post-data was collected for one week post intervention. The data was collected through FastBridge using the earlyReading letter sound subtest assessment. The FastBridge system does showcase the student's name during the assessment and progress monitoring, but in transferring the data into a spreadsheet form weekly, each student was assigned a number from one to eight to keep names anonymous when tracking and showing data results.

### **Variables**

The researcher collected quantitative data. The quantitative data has independent and dependent variables. The independent variable is the types of letter sound phonics instruction received by the control group and treatment group. The dependent variable is the academic growth seen with letter sound knowledge.

### **Measurement Tool**

The measurement tool used to measure the dependent variable was FastBridge using the earlyReading letter sound subset assessment for both the pre- and post-test. This assessment is a timed one-minute assessment where students stated as many of the letter sounds on the testing page as they can. The assessment has 100 letters in random arrangement placed on the sheet. Students individually took this test at a kidney reading table in the classroom where they could

be away from their peers as much as possible while remaining in the classroom. If a letter sound was stated incorrectly, or the student responded that they did not know the letter sound, the researcher marked it as incorrect. The researcher was allowed to state the letter sound for students if nothing had been stated for three seconds, and it was then counted as an incorrect answer. Once the one-minute timing was up, an overall score of how many letter sounds were answered correctly was automatically scored through FastBridge. This measurement tool allowed for interval data to be collected and analyzed.

To check weekly student progress, students were progress monitored using the FastBridge earlyReading letter sound progress monitoring assessment, which follows the same process as the earlyReading letter sound subset assessment. The weekly progress monitoring scores were not used in the overall data analysis and were instead completed by the researcher to gain understanding of how the control and treatment group students were progressing in their letter sound knowledge after the daily interventions.

### **Anticipated Statistical Analysis**

The data were analyzed on a four-way factorial design test. The data were split into pre-test and post-test scores. The data were analyzed based on the four questions of if the groups started off at the same level before the intervention, if the control group improved from pre-test to post-test, if the treatment group improved from pre-test to post-test, and if one group outperformed the other group on the post-test following the intervention. Two statistical tests were used: an independent samples t-test (two-sample) and a dependent samples t-test (paired). The research was intended to show if there was a greater positive change between the pre- and post-test intervention data collection for the treatment group versus the control group.

**IRB**

The action research conducted is considered exempt from the IRB process according to federal code 46.104. Although it was completed in an educational setting, the research posed minimal risk to the participants and involved normal education practices that already take place in a school setting (Legal Information Institute, n.d.). The research does not include interviews with parents or children.

**Data Collection**

Data was collected for both the pre- and post-test using the earlyReading letter sound subset assessment from FastBridge. The researcher conducted the data collection for this study using their computer and the FastBridge website. The pre- and post-test were both taken individually by students in the control and treatment groups. Students were kept in the classroom as the pre- and post-tests were conducted but were taken to the kidney reading table in the classroom for a more contained testing space. The pre-test took one week to conduct, as did the post-test.

The assessment was timed for one-minute while students stated as many of the letter sounds on the testing page as they could. The assessment has 100 letters in a random arrangement placed on the sheet. Each student had three seconds to state the letter sound. If a letter sound was stated incorrectly, or the student responded that they did not know the letter sound, it was marked as incorrect by the researcher. Once the one-minute timing was completed, an overall score of how many correct letter sounds were stated was automatically calculated and scored by the FastBridge system.

Throughout the four-week intervention students were progress-monitored using the FastBridge earlyReading letter sound progress monitoring assessment. This progress monitoring follows the same process listed above. The researcher chose to progress monitor students to check-in with intervention progress and alter any lesson structure or activities for the control and/or treatment groups as needed. The weekly progress monitoring scores were not used in the overall data analysis.

## **Findings**

### **Data Analysis**

Quantitative data was collected using a four-way factorial design test to analyze the control group's and the treatment group's pre- and post-test scores in letter sound fluency. The researcher collected data with the FastBridge earlyReading letter sound subset assessment. The researcher documented the findings in FastBridge, then transferred the data into a spreadsheet to track the students' baseline and progress over six weeks.

An independent samples t-test was conducted to determine whether there was a significant difference in prior knowledge of letter sounds between students in the control group versus students in the treatment group before the intervention started. Pretest mean scores for students in the control group ( $M = 1.5$ ,  $SD = 1.29$ ) and treatment group ( $M = 2.25$ ,  $SD = 1.70$ ) showed no significant difference,  $t[6] = -0.7006$ ,  $p = 0.5098$ . Students started the intervention at an academically equivalent level of prior knowledge with letter sounds.

All but one student in the control group made positive growth in their letter sound knowledge. The one student who did not progress decreased from two to one letter sounds per minute from the pre- to post-test. The student who made the most growth increased from three to



14 letter sounds per minute from pre- to post-test. Although most control group students made gains in their letter sound knowledge following traditional instructional methods, the gains were not as significant as the treatment group using multisensory instructional methods. All students in the treatment group made positive growth in their letter sound knowledge. The student who made the least growth increased from four to 14 letter sounds per minute from pre- to post-test, while the student who made the most growth increased from three to 35 letter sounds per minute from pre- to post-test.

A dependent samples t-test was conducted to determine whether students in the control group had a minor difference in pre-test and post-test mean scores. Students in the control group did not show improvement between the pre-test ( $M = 1.5$ ,  $SD = 1.29$ ) and post-test ( $M = 5$ ,  $SD = 6.06$ ),  $t(3) = -1.3472$ ,  $p > 0.05$ . The use of visual and auditory modalities (traditional instruction) to learn letter sounds did not significantly improve student understanding.

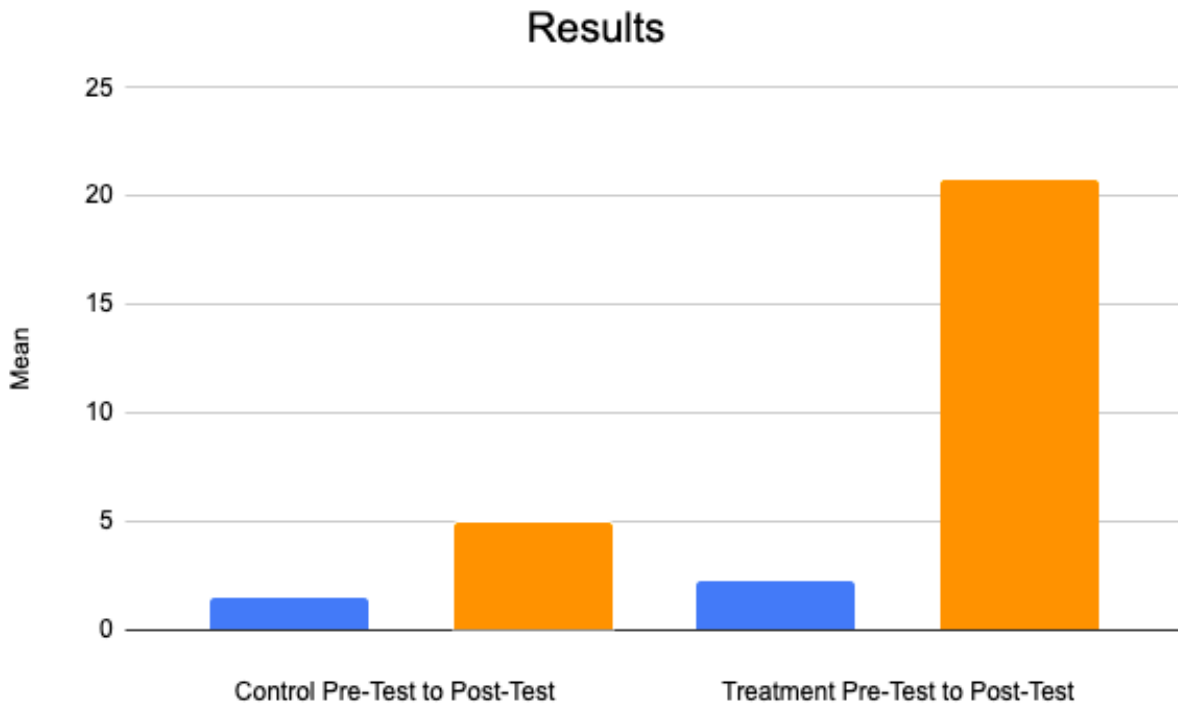
A dependent samples t-test was conducted to determine whether students in the treatment group had significantly different pre-test and post-test mean score. Students in the treatment group showed significant growth between the pre-test ( $M = 2.25$ ,  $SD = 1.70$ ) and post-test ( $M = 20.75$ ,  $SD = 9.91$ ),  $t(3) = -3.8645$ ,  $p < 0.05$ . The use of visual, auditory, and kinesthetic modalities (multisensory instruction) to learn letter sounds significantly improved student understanding.

An independent samples t-test was conducted to determine whether the small-group intervention of multisensory instructional techniques resulted in significantly different post-test mean scores between students in the control group and students in the treatment group. There was a significant difference between the post-test mean scores of students in the control group ( $M = 5$ ,  $SD = 6.06$ ) and students in the treatment group ( $M = 20.75$ ,  $SD = 9.91$ ),  $t(6) = -2.7119$ ,  $p$

= 0.0350. Small-group multisensory instruction led to a greater increase in student learning and outcomes than those who received small-group traditional methods of instruction. Figure 1 showcases the mean data results from the pre-test to post-test for the control and treatment groups.

**Figure 1**

*Pre-Test to Post-Test Results*



**Discussion**

**Summary of Major Findings**

The results of this action research study indicate that implementing small-group multisensory instructional techniques was more successful than traditional instructional techniques in improving kindergarten students’ performance in letter sound identification. Both

groups did increase their pre- to post-test averages, but significantly more growth was noted in the treatment group compared to the control group. The data compared a control group of visual and auditory modalities (traditional instruction) and a treatment group of visual, auditory, and kinesthetic modalities (multisensory instruction). The results showed that the treatment group could identify letter sounds in a one-minute timed post-test over nine times more successfully than the control group. Prior to the intervention starting, both groups were at an academically equivalent level of prior knowledge and showcased similar pre-test scores.

### **Impact on Teaching and/or Learning**

Results from the action research study signify the need for multisensory instructional techniques to be incorporated into elementary classrooms. In a six-week intervention, students who engaged in visual, auditory, and kinesthetic (multisensory) small-group phonics instruction grew in their letter sound knowledge at a quicker rate than those who engaged in visual and auditory (traditional) small-group phonics instruction. Including activities that allowed for students to incorporate movement with their hands and body to connect the appearance of the letter with the auditory sound correlated with greater learning retention of letter sounds.

The main difference in intervention learning activities between the control and treatment groups included hands-on, kinesthetic approaches. All other components of the intervention groups stayed within the same general format to accurately measure the impact of the intervention on learning growth. Although both groups increased in student learning, the multisensory approaches led to significantly greater student learning in letter sounds compared to traditionally guided instruction. Continuing this intervention has the potential for students in the treatment group to solidify their letter sound knowledge at a more significant rate than the control group to eventually guide them in the reading process.

### **Alignment to Research**

The data from this action research study supports the findings of the literature review presented in this paper that multisensory learning has a positive impact on elementary students' phonics knowledge. For example, Labat et al. (2020) recommend that when it comes to letter knowledge, audio-visual-motor multisensory experiences contribute to greater letter recognition and decoding skills than audio-visual learning experiences. This study connects with Labat et al. (2020) in that when comparing the treatment (multisensory) versus control (traditional) groups, higher letter sound knowledge results were documented in the treatment group. Pieretti et al.'s (2015) study also emphasized how multimodal approaches are effective in strengthening articulation, phonological awareness, phonics, and overall pre-literacy skills of young students. This study supports Pieretti et al.'s findings in that the treatment (multisensory) group made significant, positive growth in letter sound knowledge, which supports pre-literacy skills.

### **Limitations of the Study**

Throughout the implementation of this research, it was apparent the study had potential limitations. One of the limitations includes the size of the study as there were only eight students participating. With small sample sizes, one score can skew the data significantly. This limitation could result in other researchers finding differences in their study results if duplication were to occur with a greater number of students.

Another limitation is that all students who participated in the study receive Title I services for reading support. At the point in the year when the study was conducted, Title I teachers in the school were focusing on beginning sounds, letter names, and letter sounds with kindergarten students. One cannot be sure if the participant's post-test results were greater than they would have been without Title I reading services.

One last limitation is the timeline of the study. The action research study was completed over six weeks. A longer study, such as throughout a calendar school year, could allow for the researcher to continue implementing traditional and multisensory instructional approaches along with further phonics skills needed for the reading process. The extended time could showcase more convincingly which instructional method yields higher results.

### **Further Study**

#### **Future Research**

Future research on the impact of multisensory learning on academics continues to be needed. The data collected in this study was from a small district in west central Iowa. The kindergarten classroom the study took place in had eight at-risk students out of 18 total students participating in the study, and the study took place in one out of 21 classrooms at the early childhood level in the district. As reviewed in the literature, it is essential to look at the impact of multisensory learning in a larger study size rather than just a small-group setting. The study could be replicated as a whole classroom approach to have larger results to evaluate for the impact of multisensory learning. Another same grade level classroom in the school could be the control group so the same data comparisons could occur. The study could also be replicated in other schools around the United States that represent varying demographics, district sizes, and grade levels to obtain differentiating data results.

Future researchers could schedule a similar study to last a full calendar school year instead of strictly six weeks. This option would allow for a longer period of the interventions to be taught for the control (traditional) and treatment (multisensory) groups and show the data growth through the entire year using the FastBridge earlyReading letter sound subset assessment. Increasing the time of the study would allow for even more reliable and accurate data results to

be analyzed, leading to a more reliable conclusion on whether multisensory learning has greater phonics learning impacts than traditional learning.

Another suggestion for future research is that the interventions continue through elementary school, and the researcher follows the same group of students from the kindergarten grade level to the completion of fifth grade. The level of instructional approaches and activities could change over the years, but the study would still be implemented as a control and treatment group intervention. The research could be analyzed at the end of the students' last year of elementary school (fifth grade) to see if multisensory learning continues to have a positive impact on students' phonics and academic learning throughout their kindergarten through fifth grade school years.

### **Conclusion**

Starting phonics instruction and interventions early in a child's schooling experience promotes reading development and builds into later literacy skills (Double et. al, 2019). A way multisensory approaches helps students is through acquiring articulation skills that supports the way letter names and sounds are heard and felt, building into word text skills (Bear, 2022). Given this knowledge, this action research was designed to determine the impact of small-group multisensory instructional techniques on kindergarteners' letter sound knowledge. The multisensory intervention focused on auditory, visual, and tactile/kinesthetic activities to strengthen letter sound learning.

The results of this action research support the continued use of multisensory learning when teaching letter sounds in a kindergarten classroom. Students in the treatment (multisensory) group had significantly higher letter sound growth than those in the control

(traditional) group. This study aligns with the literature in that implementing multisensory learning correlates to increased phonics skill performance. However, more research needs to be conducted to determine whether the same results can be produced in various classrooms with differing demographics, district sizes, grade levels, and more.

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